

LARGE A.C. ARC HEATER...DESIGN, PERFORMANCE AND ECONOMICS

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After chemical performance has been demonstrated, a plasma generation device must meet several other requirements before it can be considered for an industrial process. These include: 1) stable, long-time operation on chemical feedstocks, 2) simple, rugged design, 3) minimum downtime and, 4) low capital cost.

An industrial arc heater is described in which the chemical feedstock is passed through a magnetically rotated arc discharge. A unique self-stabilizing feature permits multi-megawatt operation on line-frequency alternating current. Spurious arc extinctions are completely eliminated. A secondary feedstock, which may be a particulated solid, can be admitted axially through the arc discharge. Heat transfer between the arc and the feedstock and turbulent mixing of the reactants are enhanced by high speed arc rotation and a.c. power pulsations. Thermal efficiency and effluent enthalpy are given as functions of feedstock flow for several arc power levels.

A strong emphasis has been placed on mechanical simplicity resulting in the capability to effect fast maintenance of low cost electrodes. Capital cost is shown to be much lower than other types of plasma generation equipment for large installations because no rectification or frequency conversion equipment is needed. Operating costs, including amortization of capital investment, are given for several operating conditions.